

# Infiltration of Carbon Foam for Mid-Density Ablative Thermal Protection Systems, Phase I

Completed Technology Project (2008 - 2008)



## Project Introduction

This proposal addresses NASA's need for improved TPS materials. The incumbent CEV heatshield TPS for Orion's Block II lunar return is PICA, a low-density carbon fiber infiltrated with phenolic resin. Variants of PICA with improved thermomechanical properties would benefit future missions. This effort will create a series of "mid-density" ablative materials to fill the gap between low-density PICA and high-density Carbon-Carbon. Touchstone's carbon foam (CFOAM

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) has excellent thermomechanical properties, can be tailored to a range of densities (12 to 95 lbs/cu-ft), and has an open-cell structure allowing infiltration of high-temperature materials. Aspen Aerogels recently completed a Phase II subcontract with Touchstone demonstrating the capability of fully infiltrating CFOAM

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with phloroglucinol-furfuraldehyde carbon aerogels with chemistry similar to PICA's. Phase I will use carbon aerogel infiltration in CFOAM

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samples of 3 densities from 17 to 35 lb/cu-ft to be calcined at Touchstone to carbonize the aerogel, creating a mass of amorphous carbon within the pore structure. Filling CFOAM

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pores with pure carbon yields an inherent reduction in the TPS radiant heat transfer. Fully carbonized samples will be re-infiltrated with PICA phenolic resin, and sample characterization will be conducted via SEM to demonstrate the capability of producing small-scale Carbon Foam-Aerogel/Phenolic composites at various densities. At the end of Phase I, the TRL will be 3-4 and then 4-5 by the conclusion of Phase II.



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Ames Research Center (ARC)

### Responsible Program:

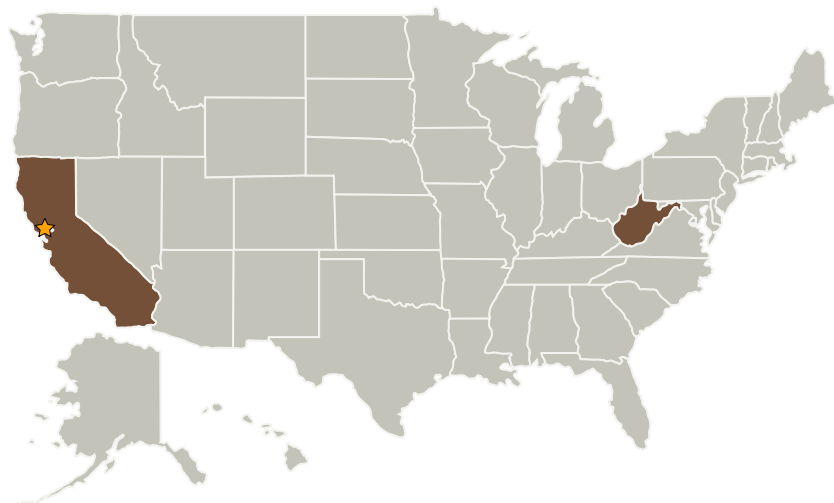
Small Business Innovation Research/Small Business Tech Transfer

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Touchstone Research Laboratory, Ltd.	Supporting Organization	Industry	Triadelphia, West Virginia

## Primary U.S. Work Locations

California	West Virginia
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## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Harry Danford

## Technology Areas

**Primary:**

- TX14 Thermal Management Systems
  - └ TX14.3 Thermal Protection Components and Systems
    - └ TX14.3.1 Thermal Protection Materials